



Mismatch of competency and self-efficacy in biology freshmen - can this inform our instruction?



Ruth E. Buskirk and Michele J. Mann. The University of Texas at Austin

Two ongoing studies of freshman biology students are comparing academic performance with information on self-efficacy as measured by survey responses. Using the Motivated Strategies for Learning Questionnaire (MSLQ), we evaluated self-efficacy of freshman students at the beginning and end of the first semester in an entry-level biology majors' course. **Analysis of items associated with self-efficacy indicate that first-semester students had a higher self-efficacy and sense of how they will do at the beginning of the course than at the end of the course.**

Questions with significant decrease over the semester:

- "I expect to do well in this biology course"
- "Considering the difficulty of this biology course, the teacher, and my skills, I think I will do well."

Questions with non-significant trends for a decrease from beginning to end of semester include:

- "I believe I will receive an excellent grade in this biology class."
- "I am confident that I can understand the basic concepts taught in this biology course."
- "I am certain I can master the skills being taught in this biology course."

For the 71 students who completed both pre- and post-semester surveys **we found a statistically significant difference in biology course grade and overall semester GPA**, $t(70) = -1.77$, $p = .082$, indicating that overall GPA was higher than the students' grade in their biology course. Most entering freshman science majors are in the top group of their high school classes; therefore, they are likely accustomed to earning A grades up until this point and are overly-confident.

Since self-efficacy can play an important role in students' academic success, **instructors can enhance student performance by specifically identifying content goals and thinking skills and by providing assessment and feedback to make students aware of their own mastery.**

Results from a 15-item attitudinal survey (5 point scale) at the beginning and end of a second-semester freshman research seminar indicate that **student perception of self-efficacy is related to whether the thinking skills were specifically identified as learning objectives in the course**. Three cohorts of students ($n=76$) were surveyed in January, following a Critical Thinking course (*course 1*) with clear, well discussed objectives, and in May concluding a seminar (*course 2*) focused on reading primary literature and introducing research projects.

Emphasis of course:	Survey Item statement "I can . . ."	Self-efficacy after course 1	Self-efficacy after course 2	Change during sem.
2	"find articles in prof. journals"	3.13 ± 0.7	3.93 ± 0.7	increase
1 & 2	"critically read articles"	3.63 ± 0.7	3.96 ± 0.7	increase
2	"identify patterns in data"	3.43 ± 0.9	4.02 ± 0.8	increase
1	"recognize a sound argument & evidence"	3.72 ± 0.8	4.17 ± 0.7	no change
1	"develop logical argument"	3.76 ± 0.7	4.06 ± 0.6	no change
-	"work effectively with others"	4.13 ± 0.8	4.58 ± 0.9	no change
2	"I am enthusiastic about reading scientific papers"	3.28 ± 1.0	3.24 ± 0.9	no change
-	"I am interested in taking more classes in biology"	4.39 ± 0.6	4.47 ± 0.7	no change
2	"I am confident I can read articles in biology"	3.28 ± 0.8	3.94 ± 0.7	increase

For 46 students in two cohorts of mainly under-represented minorities, there was no relationship between a student's semester GPA and either the initial or the semester-end self-efficacy ratings, per se. However, the **direction of change in response from beginning to end of the semester was related to grade success**. *Decrease in self-efficacy*: Of 16 students whose semester-end self-ratings were significantly lower than at the beginning of the semester, only 2 students had A grades in Introductory Biology as well as a semester GPA over 3.50. *Increase in self-efficacy*: Of 22 whose self-ratings were higher at semester end than at the beginning of the semester, most achieved A, A- or B+ grades and only three students had a semester GPA under 3.00.